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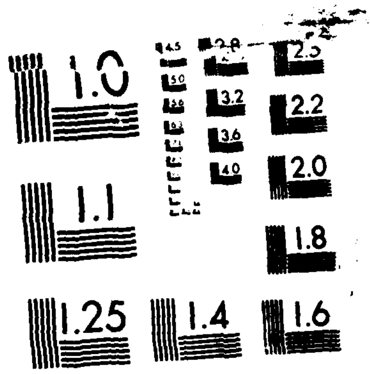

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Organizations As Information Processing Systems

Office of Naval Research
Technical Report Series

Environmental Characteristics,
Company Performance, and Chief
Executive Scanning:
An Empirical Study

Richard Daft
Juhani Sormunen
Don Parks

April 1986
TR-ONR-DG-20

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Chief executives in fifty manufacturing companies were interviewed about the perceived strategic uncertainty in six environmental sectors, and the frequency and mode of scanning used for each sector. The findings suggest customer, economic, and competitor sectors generated greater strategic uncertainty than technological, regulatory, and socio-cultural sectors. When sector uncertainty was high, executives reported greater frequency of scanning and greater use of personal information sources. Chief executives in high performing companies

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) scanned more frequently and more broadly in response to strategic uncertainty than their counterparts in low performing companies.

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ENVIRONMENTAL CHARACTERISTICS, COMPANY PERFORMANCE, AND CHIEF EXECUTIVE SCANNING: AN EMPIRICAL STUDY

Abstract

Chief executives in fifty manufacturing companies were interviewed about the perceived strategic uncertainty in six environmental sectors, and the frequency and mode of scanning used for each sector. The findings suggest customer, economic, and competitor sectors generated greater strategic uncertainty than technological, regulatory, and socio-cultural sectors. When sector uncertainty was high, executives reported greater frequency of scanning and greater use of personal information sources. Chief executives in high performing companies scanned more frequently and more broadly in response to strategic uncertainty than their counterparts in low performing companies.

ENVIRONMENTAL CHARACTERISTICS, COMPANY PERFORMANCE, AND CHIEF EXECUTIVE SCANNING: AN EMPIRICAL STUDY

Environments create both problems and opportunities for organizations. Organizations depend on the environment for scarce and valued resources, and organizations often must cope with unstable, unpredictable external events. The environment, perhaps more than any other factor, affects organizational structure, internal processes, and managerial decision making (Duncan, 1972; Pfeffer and Salancik, 1978). A body of research has found that strategy, planning, coordination, structural complexity, and organic versus mechanistic work processes tend to "fit" environmental characteristics (Tung, 1979; Lawrence and Lorsch, 1967; Burns and Stalker, 1961; Lindsay and Rue, 1980; Javidan, 1984).

From an information processing perspective, the environment is important because it creates uncertainty for managers, especially top managers. Environmental uncertainty increases information processing within organizations because managers must detect and interpret events, and implement strategic or structural adaptations (Hambrick, 1982; Culnan, 1983; Tushman, 1977; Jemison, 1984; Galbraith, 1973). One means of competing is for firms to acquire superior information about the environment. An information advantage depends on the perception of signals that other organizations miss (Dutton and Freedman, 1984).

Despite research on environmental uncertainty, the question remains, how do senior managers learn about the environment? Environmental scanning is the means through which top managers perceive external events and trends (Hambrick, 1982; Culnan, 1983). Scanning represents a difficult organizational problem because the environment is vast and complex, and managers experience bounded rationality--they can't comprehensively understand the environment (Cyert and March, 1963). Senior managers must find scanning mechanisms that yield adequate information displays of external events. While a number of studies have explored the fit between organization and environment, there is less knowledge about how impressions of the environment are formed among top managers who are responsible for responding with new strategies and structures. The purpose of this paper is to introduce evidence about the perceived uncertainty of external sectors, the means through which chief executives of manufacturing firms acquire information about these sectors, and chief executives' scanning patterns in high and low performing companies.

The potential significance of this research is based on four assumptions. First, scanning is the first link in the chain of perceptions and actions that permit an organization to adapt to its environment (Hambrick, 1981). Scanning provides the external intelligence that is used in planning, decision making and strategy formulation (Ansoff, 1979; Rhyne, Hofer and Schendel, 1978; Rhyne, 1985; Miles, 1982; Meyer, 1979).

Second, chief executives are responsible for the organization/environment alignment. Of course, chief executives do not do all scanning (Hambrick, 1979; Aguilar, 1967; Kefalas and Schoderbek, 1973), but they are responsible for bringing together specialized information from various functions and levels. Coalignment between strategy, structure, and environment is performed at the institutional level (Ritvo, Salipante, and Notz, 1979).

Third, senior managers have limited time and capacity yet they must choose among scanning alternatives. Executives may scan broadly across the general environment or focus narrowly on sectors in the task environment. Organizations may attain a strategic information advantage or disadvantage depending on how scanning is conducted (Rhyne, 1985; Hambrick, 1982).

Identifying executive scanning patterns in high and low performing companies may provide insight into effective scanning processes.

Fourth, there is a continuing puzzlement about formal versus informal scanning in organizations. A complex environment would seem to call for the increased use of sophisticated scanning systems. Executives have access to various media, yet most information at top levels is gained through ad hoc, human sources (Preble, 1978; Thomas, 1980; Hambrick, 1982; Mintzberg, 1973; Kefalas and Schoderbek, 1973). Executives may talk to a peer in another company, call an immediate subordinate, or read an internal report or professional journal. Top management scanning tends to be irregular rather than systematic (Fahey, King, and Narayanan, 1981). An examination of formal and informal information media is a prerequisite to developing normative findings about how organizations and chief executives can achieve effective scanning.

Theoretical Background and Hypotheses

Environmental Sectors and Strategic Uncertainty

The environment was defined by Duncan (1972) as the relevant physical and social factors outside the boundary of an organization that are taken into consideration during organizational decision making. Initial research treated the environment as a single entity (Duncan, 1972; Tung, 1979). Recent studies have decomposed the environment into sectors, each of which may have distinct influence on organizational actions (Hambrick, 1979, 1982; Bourgeois, 1980; Boulton, Lindsay, Franklin, and Rue, 1982; Brown and Utterback, 1985).

The environment can be conceptualized as having several sectors that exist in two layers (Bourgeois, 1980). The layer closest to the organization is the task environment which includes sectors that have direct impact on organizational actions. The task environment influences day-to-day organizational operations and goal attainment and includes sectors such as competitors, suppliers, and customers. The outer layer is called the general environment and refers to sectors that affect all organizations about equally and do not have differential impact on the operations and goal attainment of organizations. The general environment often includes social, demographic, political, and economic sectors.

Sectors in the task and general environments influence scanning and other organizational activities because these sectors differ in uncertainty. *Perceived environmental uncertainty* is the absence of information about organizations, activities, and events in the environment (Huber, 1984). Uncertainty means that managers cannot predict events, and they are unclear about the probable success of organizational actions. Two environmental characteristics, complexity and rate of change, influence perceived uncertainty (Duncan, 1972; Jurkovich, 1974; Tung, 1979). *Complexity* is the number of external events that influence the organization. *Rate of change* refers to the pace, turbulence, and unpredictability of external events (Child, 1972). As complexity and rate of change in environmental sectors increases, the amount of uncertainty perceived by top managers also increases (Duncan, 1972). Greater uncertainty increases the need for information because the risk of failure is greater and it is more difficult to compute potential costs and successes associated with decision alternatives.

Environmental sectors also differ in their *perceived importance* for organizational performance (Aaker, 1983). Importance is related to the notion of strategic contingency, which is the extent to which events directly influence the attainment of organizational goals (Pfeffer, 1981; Daft, 1986; Hickson, Hinings, Lee, Schneck, and Pennings, 1971). Information from important sectors may provide strategic advantage (Dutton and Freedman, 1984). In a low importance sector, activities and events hardly affect the organization's performance. In a high importance sector, events are perceived to be directly linked to operations and performance. For an emerging company in the personal computer industry, the technological sector would be considered strategically important because of the pace of technological developments. For medical, banking and airline industries, the regulatory sector has become increasingly important as the government has issued new regulations or rescinded old regulations. Top managers will tend to direct their attention to environmental sectors that are perceived to be strategically important for organizational performance (Boulton, et al., 1982).

Uncertainty and importance are expected to differ across environmental sectors. Uncertainty and importance together create what we will call "strategic uncertainty" for top managers. The combination of perceived uncertainty and importance is expected to generate a need to learn about events in environmental sectors. The information need is expected to be greater for sectors in the task environment than for sectors in the general environment. The task environment is expected to change more rapidly, to be complex, and to be perceived as more important. Customers' tastes change, competitive strategies change, and the organization must respond quickly to unpredictable events. Government policy or social demographics may gradually affect the organization, but a large number of customers and competitors may affect performance on a day-to-day basis. The first research hypothesis is about perceived sector differences.

<u>Hypothesis 1</u>: Sectors in the task environment create

greater perceived strategic uncertainty for top executives than sectors in the general environment.

Scanning Behavior

Executives can learn about the environment in several ways. They may scan the environment directly or learn from others in the organization. They may increase or decrease the frequency with which they scan, and they may select among information modes or channels. Scanning frequency is the number of times executives receive data about the environment (Hambrick, 1981; Farh, Hoffman and Hegarty, 1984). Scanning mode pertains to the source or medium through which executives learn about the environment. Mode is derived from Aguilar's (1967) designation of information sources as personal, impersonal, internal or external.

Scanning frequency. Research into manager scanning behavior suggests that frequency of scanning indicates amount of information obtained about the environment (Hambrick, 1982). Managers may gather a large or small amount of data about environmental sectors. For example, Aguilar (1967) found that some managers were relatively passive and simply "viewed" the environment while other managers actively "searched" for desired information. Fahey and King (1977) argued that managers could receive information along a continuum from irregular to continuous gathering. Depending on the nature of the environment executives may process data irregularly or continuously depending upon the perceived need for data about external events.

Managers are extremely busy, and they have limited capacity for information search (Cyert and March, 1963; Hambrick, 1981). Should they scan all sectors equally or focus narrowly on specific sectors? We expect that frequency of scanning will differ by sector and will be related to strategic uncertainty. The reason is that strategic uncertainty reflects the strategic value of information for organizational performance. Hence executives will more frequently receive data about strategically uncertain sectors. Hypothesis 1 proposed that perceived strategic uncertainty would be greater in the task environment. Chief executive response to sector differences is hypothesized as follows.

> Hypothesis 2: Top executive scanning frequency will differ across sectors and will have a positive relationship with sector strategic uncertainty.

Scanning mode. Previous research also indicates that senior executives use different information modes to learn about the environment. The distinction used here is between personal and impersonal sources of information and whether information comes from sources external or internal to the organization (Aguilar, 1967; Culnan, 1983). Personal sources refer to direct human contact as typified by face-to-face and telephone media. Impersonal sources are written, and include formal reports, newspapers, survey results, and the output of management information systems. Personal versus impersonal is analogous to the human versus documentary sources described by Kefalas and Schoderbek (1973).

A puzzlement in the literature is whether personal or impersonal sources are better suited for interpreting an uncertain environment. Personal sources of information have been found important to executives (Keegan, 1974), and are consistent with the informal, irregular scanning that typifies many organizations (Fahey and King, 1977; Thomas, 1980). On the other hand, the ability to condense a broad base of data into written form could make impersonal sources useful for environmental scanning. Recent research into managerial information processing suggests that personal sources of information are richer than written sources (Daft and Lengel, 1984, 1986; Holland, Stead, and Leibrock, 1976). Face-to-face and telephone information exchanges provide multiple cues and allow for rapid feedback, thereby facilitating understanding. Top managers deal with ambiguous, ill-defined events so that multiple cues and rapid feedback are needed to resolve ambiguity. Several studies found that task uncertainty was associated with more frequent face-to-face communication and group meetings (Van de Ven, Delbecq, and Koenig, 1976; Holland, et al., 1976; Daft and Lengel, 1986). The explanation for source selection is that communication modes fit the communication content. Personal, face-to-face communications are preferred when events are unclear and managers need feedback and extended discussion. Personal communications are content rich and enable executives to detect weak signals (Ansoff, 1975). Impersonal sources are appropriate when environmental events are discrete and analyzable. Thus the dilemma between formal and informal information sources may reflect different communication requirements. When strategic uncertainty is high, personal sources may provide the direct understanding needed by senior executives to interpret equivocal issues (Weick, 1979). This explanation is represented in the third hypothesis.

> Hypothesis 3: Perceived strategic uncertainty in environmental sectors will be positively associated with use of personal sources and negatively associated with use of impersonal sources of information about the environment.

The other distinction in sources identified by Aguilar (1967) and Culnan (1983) is whether scanning information originates internal or external to the firm. Internal information pertains to data, reports, memos, or discussions with internal managers and employees about the external environment. External sources include personal tours, telephone discussions with peers in other companies, trade magazines, newspapers, information services, and attendance at association meetings. Since other people within the organization also scan the environment, top executives might be inclined to use both external and internal sources for information. However, as strategic uncertainty increases, it is expected that senior executives will want to form their impression through direct contact with environmental sectors. Direct contact will mean that data are undiluted and do not suffer from the loss of meaning associated with passing information through intermediaries. Moreover, research indicates that internal information tends to be distorted as it is passed up the hierarchy (Downs, 1966; O'Reilly, 1978; Roberts and O'Reilly, 1974). Internal sources will still be used when uncertainty is high, because top managers may wish to discuss their interpretation with others. On average, however, senior executives are expected to respond to strategic uncertainty in the environment through direct external contacts in the relevant sector.

> Hypothesis 4: Perceived strategic uncertainty in environmental sectors will have a positive relationship with the use of external sources and a neutral relationship with the use of internal sources of scanning information.

The hypothesized relationships between perceived uncertainty and the scanning behavior of chief executives is illustrated in Figure 1. Sector complexity and rate of change lead to perceived sector uncertainty. Sector uncertainty combined with perceived sector importance create strategic uncertainty for the chief executive. We expect that strategic uncertainty will be associated with both the frequency and mode of scanning, as reflected in greater frequency and greater use of personal and external information sources. Sectors characterized as having low strategic uncertainty are hypothesized to be associated with infrequent scanning and greater use of impersonal sources of information.

Figure 1 about here

The final hypothesis pertains to expected CEO scanning patterns between high and low performing organizations. If the logic underlying the Figure 1 model is correct, the relationships should be observed in high performing more than in low performing firms. For example, a study of 21 U.K. companies revealed that financial performance was strongly correlated with the use of informal channels of communication and was modestly correlated with the number of information items used (Grinyer and Norburn, 1975). Informally acquired information often triggered performance reviews. In these firms, performance was not correlated with the use of formal channels of communication. Despite this evidence, it would not be accurate to claim that scanning leads directly to company performance because performance is caused by a number of factors (Hirsch, 1975; Kanter and Brinkerhoff, 1981; Hambrick, 1983; White and Hamermesh, 1981). However, by comparing high and low performing firms, it may be possible to determine which scanning style is used in better performing companies. Firms that are consistently profitable over a period of time may have made more accurate interpretations of the environment, and hence the firm may be in alignment with the environment. Comparing firm performance could provide evidence about the nature, focus, and sources most appropriate for chief executives to acquire information about the environment.

> Hypothesis 5: The relationships in Hypotheses 2 through 5 will be stronger in high performing than in low performing organizations.

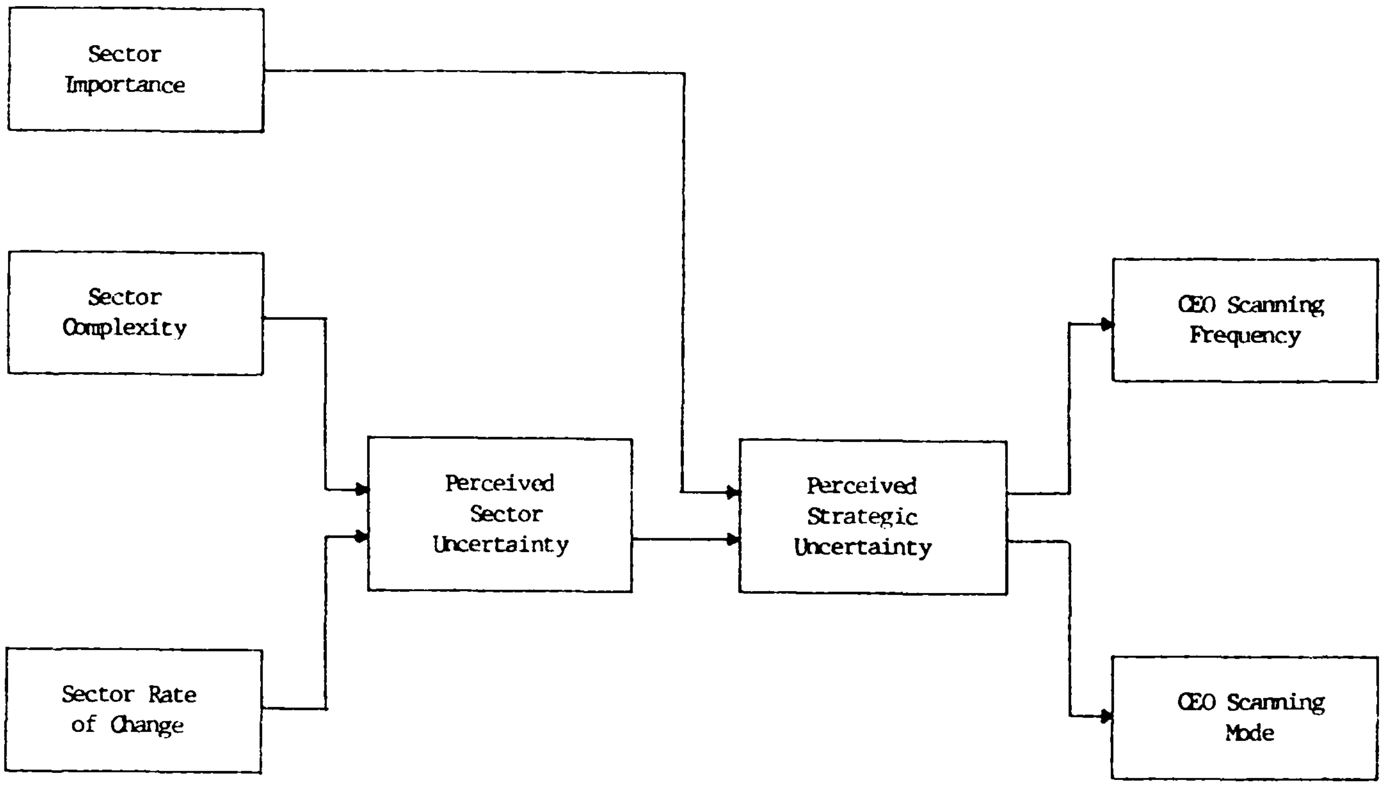

Figure 1. Model of Chief Executive Scanning Behavior.

In summary, our theory is that the environment can be broken into sectors that have different levels of strategic uncertainty for chief executives. Strategic uncertainty will be associated with greater scanning frequency and with differences in personal, impersonal, internal and external information sources because of the need for accurate understanding and content rich data. Top managers are hypothesized to direct their scanning toward the uncertain sectors and to use sources that provide a better picture of the environment. The scanning patterns also will be compared to organizational performance.

Research Method

Sample Selection

Sample selection was designed to include firms for which environmental sectors could be clearly defined. The sample also needed to include firms for which performance could be measured. These criteria lead to the selection of medium-sized, single business manufacturing companies. A single business means the company has a defined task environment, which is not the case when the company is responsible for multiple businesses operating in multiple environments. Moreover, the selected firms were independent businesses, so scanning behavior would be the result of environmental forces rather than the policy of a parent corporation. The final criterion was that the companies be large enough to have the structural and behavioral characteristics of established organizations rather than of new entrepreneurial firms.

All firms fitting these criteria were drawn from the Directory of Texas Manufacturers. Seventy-three firms were selected for possible inclusion in the study. The seventy-three firms were contacted, and fifty agreed to participate in the research. The final sample included fifty small to medium-sized manufacturing firms with annual sales ranging from $2 million to $500 million, with a mean of $65 million. The number of employees ranged from 100 to 6,000. The sample firms included 29 four-digit SIC groups and 11 two-digit SIC groups. The firms were located in the geographical areas of Houston, San Antonio, Dallas, and Fort Worth, and there were very few direct competitors. Example firms included Alamo Steel Co., Blue Bell Creameries, Brandom Kitchens, Lufkin Industries, Otis Engineering, Plantation Foods, Rochester Gauges, and Tracor Aerospace.

Data Collection

Interviews. The data were collected through personal interviews with the chief executives in their offices. The focus of the research was on chief executive scanning, not scanning for the organization as a whole. The personal interview enabled the interviewer to explain the study to the respondent, answer questions, and to ensure that the respondent understood the questions. Of the fifty interviews, forty-one were with the chief executive officer of the firm. Of the remaining nine interviews, two were with manufacturing vice presidents, three were with executive vice presidents, and four were with senior vice presidents designated by the president to have general management responsibility.

Variables. The interviews were the primary source of data to measure the environment and scanning variables. Questions were tested and revised through a series of pilot interviews with executives not included in the final sample. The final interview format included three parts.

1. The executive was given a chart that illustrated the six environmental sectors of customer, competition, technological, regulatory, economic and socio-cultural. The executive was also given a written

definition of each environmental sector which was read aloud and explained by the interviewer. The list of sector definitions is in the Appendix.

2. After the executive understood the six sectors, he was asked to answer questions about the complexity, rate of change, and importance of each sector. These responses were measured on five-point Likert scales. For example, the concept of change was defined and the respondent assessed the perceived "rate of change" in each sector. Assessing six sectors simultaneously enabled the executive to compare sectors and distinguish rates of change among them. The change question as it appeared on the questionnaire is as follows.

The next question pertains to the amount of change taking place in each environmental sector. Change means the extent to which the important companies, agencies, problems, trends, issues, or opportunities change over time in your company's external environment. A low rate of change means things stay about the same from year to year, and a high rate of change means things change quickly and unpredictably from year to year. Based upon the same 5-point scale, how would you rate the change of each environmental sector?

	Rate of Change				
	Low				High
a. Competition sector	1	2	3	4	5
b. Customer sector	1	2	3	4	5
c. Technological sector	1	2	3	4	5
d. Regulatory sector	1	2	3	4	5
e. Economic sector	1	2	3	4	5
f. Socio-cultural sector	1	2	3	4	5

3. Scanning was measured using frequency questions similar to those developed by Hambrick (1982) and Culnan (1983) and validated by Farh, Hoffman, and Hegarty (1984). The questions distinguished between internal vs. external

sources and personal vs. impersonal (written) sources. The executive was given examples of information from each source, and then was asked to indicate whether useful information was received about each sector on a daily, weekly, monthly, or less frequent basis. For example, the question for external written information is as follows.

WRITTEN SOURCES OUTSIDE THE COMPANY

Written sources of information from outside your company include such things as trade magazines, newsletters, newspapers (e.g., Wall Street Journal), government reports, books, information services, and the like. Using the following scale, would you tell us how often you generally receive useful information from external written sources? We stress useful information to mean that it helps you understand the environment and plan company actions. Material you receive and do not use should not be counted. From external written sources, then, how often do you generally receive useful information?

	Written External Sources				
	Daily	Weekly	Monthly	Few Times a Year	Less than Once a Year
a. Competition sector	1	2	3	4	5
b. Customer sector	1	2	3	4	5
c. Technological sector	1	2	3	4	5
d. Regulatory sector	1	2	3	4	5
e. Economic sector	1	2	3	4	5
f. Socio-cultural sector	1	2	3	4	5

An additional variable to be operationalized for the Figure 1 model is "strategic uncertainty." Strategic uncertainty is a combination of rate of change, complexity, and importance of events in each sector. Complexity and rate of change have traditionally been combined as an indicator of environmental uncertainty (Duncan, 1972; Tung, 1979). In this study, the variable of sector "importance" is combined with "uncertainty" as a predictor of the need for information impinging upon the chief executive. Importance and uncertainty were combined with equal weight as an indicator of perceived strategic uncertainty. The following formula was used to construct the score for the strategic uncertainty variable for each environmental sector.

SU = I(C + R), where SU = strategic uncertainty

I = sector importance

C = sector complexity

R = sector rate of change

C + R = uncertainty.

Data analysis. Data analysis involved several statistical procedures. The simple means and rank order for each uncertainty and scanning characteristic was computed for each of the six sectors. Scheffe's multiple range test was calculated to determine statistically significant differences across sectors for each variable. Next, Pearson correlations were computed between the major independent and dependent variables. Major environmental and scanning differences occur across sectors, so sectors were treated as the unit of analysis (N = 300, six sectors for fifty organizations) for part of the analysis. Missing values reduced the size of the sample to 294. The later part of the analysis compared successful and unsuccessful firms and was based on the N = 50 firms.

Performance. Profitability was the measure of performance. The exact measure was return on total assets (ROA). ROA was selected as the most consistent measure of profitability across the variety of manufacturing firms in the study. The calculation for ROA is: ROA = net income after taxes divided by total assets. ROA was averaged for three years, 1981 through 1983, to decrease the chance of a one year aberration influencing results. ROA had an average correlation from year to year of .62 ($p < .001$). The ROA data were self reported. Most of the firms were privately or closely held, so profitability data were not publicly available. Dess and Robinson (1984) found that where objective, public data was not available, reports by managers were very reliable. The senior manager reported profitability on the following scale:

Return on Total Assets (ROA)	1981	1982	1983
1. 20% or more	____	____	____
2. 16% to 19.9%	____	____	____
3. 12% to 15.9%	____	____	____
4. 8% to 11.9%	____	____	____
5. 4% to 7.9%	____	____	____
6. 0% to 3.9%	____	____	____
7. -3.9% to 0%	____	____	____
8. -4.0% or less	____	____	____

Results

Profile of Sector and Scanning Characteristics

The profile of sector characteristics and scanning modes are reported in Table 1. The mean scores in Table 1 are based on five-point Likert scales that range from 1 (very low) to 5 (very high). The ranks in Table 1 indicate statistically significant differences between sectors. For example, if sectors are ranked 1 and 2, the sector ranked 1 has a statistically significant higher mean score than sector 2.

Table 1 about here

The mean scores and ranks in Table 1 suggest several points. First, customer and competitor sectors are perceived to be most important, followed by economic. Regulatory and socio-cultural sectors are least important. Second, the customer sector is most complex, probably because of a large number of customers, followed by economic and competitor sectors. Third, rate of change in the economic sector is greatest, followed by customer and competitor sectors. Although the economic sector is considered to be part of the general environment, it was having substantial impact on chief executives in these fifty manufacturing companies. On average, the economic sector was ranked just behind customers and competitors in terms of sector characteristics.

With respect to scanning modes, personal external, personal internal, and written internal are all ranked first for the customer sector. All three scanning modes are used more frequently than for any other sector. The written internal mode is ranked first for scanning of the economic sector, perhaps because most data about the economy come in the form of published reports. The socio-cultural sector was ranked lowest for all four scanning modes.

The profiles in Table 1 indicate major differences in perceived sector characteristics and in chief executive scanning of the sectors. These differences provide the background for testing the hypotheses.

Hypothesis 1. The first hypothesis predicted that disaggregating the environment into sectors would show that the task environment created more strategic uncertainty than the general environment. Strategic uncertainty for

Table 1: Means and Rankings for Environmental Characteristics and Scanning Behavior.

Sector	Sector Characteristics						Scanning Modes							
	Importance		Complexity		Rate of Change		Personal External		Personal Internal		Written External		Written Internal	
	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean
TASK ENVIRONMENT:														
Customer	1[a]	4.5[b]	1	4.3	1/2	3.2	1	3.1	1	3.6	2	2.4	1	3.1
Competitor	1	4.3	2	3.0	3	3.1	2	2.7	1	3.4	2	2.2	2	2.7
Technological	4	3.1	4	2.5	4	2.7	4	1.9	3	2.6	4	2.0	4	1.9
GENERAL ENVIRONMENT:														
Economic	3	4.1	2	3.2	1	3.4	2	2.8	3	2.7	1	3.2	2	2.8
Regulatory	5	2.7	5	2.2	5	2.2	5	1.5	5	1.8	5	1.8	5	1.5
Socio-Cultural	6	2.2	6	1.7	6	2.0	5	1.5	6	1.6	5	1.6	5	1.6

[a] Differences in rank order are significant at .05 level.

[b] 1 = low; 5 = high.

the chief executive was defined as the combination of sector importance, complexity, and rate of change. Perceived strategic uncertainty across the six sectors are reported in Table 2.

Table 2 about here

Based on Scheffe's multiple range test at the .05 significance level, the Table 2 data indicate that each sector presents a different level of strategic uncertainty. The sectors in decreasing order of strategic uncertainty are customer, economic, competitor, technological, regulatory, and socio-cultural. The mean score for each sector is statistically different from all other sectors.

Hypothesis 1 about task versus general environment sectors is mostly supported. Two of the top three strategically uncertain sectors--customer, competitor--are in the task environment. The economic sector, normally considered a part of the general environment, is ranked second in strategic uncertainty. For this sample of manufacturing firms, the economic sector was especially salient to chief executives. Several years of economic changes had been witnessed prior to 1984, so the uncertainty and importance attached to economic conditions were high.

The technological sector, which was considered part of the task environment for manufacturing firms, is ranked fourth. The technological sector was important, but had less strategic uncertainty than customer, economic and competitor sectors. The regulatory and socio-cultural sector had minor uncertainty for these firms. These organizations were not tightly regulated at the local, state, or federal level, nor were socio-cultural changes having direct impact on them.

Table 2: Difference Among Sectors for Strategic Uncertainty.

Scanning Stimulus Mean	Sector	a.	b.	c.	d.	e.	f.
3.4	a. Customer (task)		*	*	*	*	*
2.8	b. Economic (general)			*	*	*	*
2.6	c. Competitor (task)				*	*	*
1.8	d. Technological (task)					*	*
1.2	e. Regulatory (general)						*
1.0	f. Socio-Cultural (general)						

The mean scores were divided by 10 to recapture original scale.

Note: Asterisks denotes significant difference between sectors at .05 level based on Scheffe's multiple range test.

<u>Hypothesis 2</u>. The second hypothesis suggested that frequency of scanning by top managers would differ across sectors and would have a positive association with perceived strategic uncertainty. This hypothesis was tested in two ways. First, scanning differences across sectors is reported in Table 3, where the mean scanning frequency score for each sector is in the first column. Table 3 shows some significant differences in the pattern of scanning frequency across sectors, according to Scheffe's multiple range test. The differences that are not significant are regulatory versus socio-cultural, and economic versus competitor sectors. The customer sector is scanned most frequently, followed by the economic and competitor sectors. The rank order sequence in Table 3 is exactly the same as the sequence in Table 2. The more frequently scanned sectors are where strategic uncertainty is higher.

The second test of Hypothesis 2 was to compute a correlation coefficient between the strategic uncertainty scores and scanning frequency for all scanning modes. The correlation coefficient between total scanning frequency and strategic uncertainty across the sectors is .58, which is significant beyond the .001 level. This finding supports Hypothesis 2 and indicates that strategic uncertainty is a good predictor of the frequency with which top executives scan sectors.

Table 3 about here

<u>Hypotheses 3 and 4</u>. Hypotheses 3 and 4 predicted that as strategic uncertainty in the environment increased, senior executives would rely more heavily on personal sources than on impersonal, written sources, and on external rather than internal sources. The data concerning these sources were collected in four modes.

Table 3: Differences Among Sectors for Scanning Frequency.

Scanning Frequency Mean	Sector	a.	b.	c.	d.	e.	f.
3.56	a. Customer (task)		*	*	*	*	*
3.35	b. Economic (general)				*	*	*
3.34	c. Competitor (task)				*	*	*
2.65	d. Technological (task)					*	*
2.16	e. Regulatory (general)						
1.98	f. Socio-Cultural (general)						

Note: Asterisks denotes significant difference between sectors at .05 level based on Scheffe's multiple range test.

1. Written external sources (Wall Street Journal, trade magazines, information services).
2. Written internal sources (special studies, reports, memos, MIS).
3. Personal external contacts (business associates, officials, customers, trips).
4. Personal internal contacts (subordinates, salesmen, staff people).

In addition, four new variables were created to reflect exclusively written, personal, external, and internal sources. These four variables overlap the four variables above, but enable a specific test of Hypotheses 3 and 4.

1. All written = (written external + written internal)/2
2. All personal = (personal internal + personal external)/2
3. All external = (written external + personal external)/2
4. All internal = (written internal + personal internal)/2

The correlations between strategic uncertainty and each scanning mode, the significance level, and the rank of correlation are reported in Table 4. The primary finding in Table 4 is that all correlations are positive and statistically significant. This means that every scanning mode is used more frequently when strategic uncertainty is high. When sectors are uncertain the acquisition of information by top executives is greater through all modes.

Table 4 about here

The first part of Hypothesis 3, that personal sources would be used more as strategic uncertainty increased, receives support. In Table 4, the highest correlation (r = .55) is between personal contacts and strategic uncertainty. The higher the uncertainty in environmental sectors, the more frequently top

Table 4: Correlation Coefficients Between Strategic Uncertainty and Frequency of Scanning Modes.

Frequency of Scanning Mode	Sector Strategic Uncertainty	
	Correlation Coefficient	Rank of Correlation
Written external	.41**	7
Written internal	.37**	8
Personal internal	.54**‡	2
Personal external	.49**‡	5
All written	.48**	6
All personal	.55**†	1
All external	.53**	4
All internal	.53**	3
All Modes	.58**	

** = significant at .01 level

† = all personal is statistically greater than all written (.05 > p < .10).

‡ = personal internal and personal external are statistically greater than written internal and written external (p < .05).

executives rely on personal contacts both within and outside the organization. The second part of Hypothesis 3, that written sources would be negatively correlated with strategic uncertainty, is rejected. The frequency of scanning via all sources increases with perceived strategic uncertainty. However, personal sources have slightly higher correlations with strategic uncertainty than written sources. Frequency of written sources does not increase as rapidly with strategic uncertainty, partially supporting the idea that personal sources are preferred when strategic uncertainty is high. The lowest correlation is for written internal ($r = .37$), which implies that its use does not increase as rapidly as strategic uncertainty increases.

Hypothesis 4 predicted that external sources would have a positive correlation and internal sources a neutral correlation with strategic uncertainty. The later part of this hypothesis is rejected. The correlation for internal sources ($r = .53$) and external ($r = .53$) are identical. Senior managers relied as much on internal discussions with employees and internal reports as they did on external media or personal contacts.

In sum, the use of both written and personal sources of scanning by chief executives increases as information need increases, but some shift to personal sources seems to occur, which provides modest support for Hypothesis 3. There is no difference in the use of internal and external sources, although both are used more frequently as strategic uncertainty increases.

<u>Hypothesis 5</u>. The final hypothesis stated that chief executives in firms classified as high performing will show stronger predicted relationships for Hypotheses 2, 3 and 4 than will executives in lower performing firms. High performing firms are those that reported an average three year ROA of 9 percent or greater; low performing firms reported an ROA of less than 9 percent. Nine percent was chosen because it is the median ROA for firms in

the sample. Table 5 reports the correlation between strategic uncertainty and scanning frequency by firm performance.

The data in Table 5 suggest three patterns. First, correlations between strategic uncertainty and all modes are positive for both high and low performing firms. All chief executives in the sample report receive information more frequently when perceived uncertainty is high. Second, high performing firms show consistently higher correlations between strategic uncertainty and scanning frequency for each mode than do low performing firms. Several of these differences are statistically significant. The higher correlations mean that CEOs tailor scanning more closely to perceived uncertainty. Scanning efforts are focused more directly on areas of strategic uncertainty and information need.

Table 5 about here

The third pattern in Table 5 is the somewhat higher correlations for personal modes compared to written modes, especially for firms classified as high performing. For example, the strongest correlation is personal contacts (r = .62) and the second strongest is personal internal (r = .61), and these coefficients are significantly higher than for low performing firms. The lowest correlations for both high and low performing firms are written modes. Of course all modes are positively correlated with strategic uncertainty, but in high performing firms chief executives increase scanning through all modes as strategic uncertainty increases and the increase tends to be greater for personal than written sources.

The final test of Hypothesis 5 examines the extent to which chief executives in high versus low performing organizations scan each sector.

Table 5: Correlation Coefficients Between Strategic Uncertainty and Frequency of Scanning Modes for High and Low Performing Companies.

	Sector Strategic Uncertainty			
	High Performing Companies		Low Performing Companies	
Frequency of Scanning Mode	Correlation Coefficient	Rank	Correlation Coefficient	Rank
Written external	.45	(7)	.35	(7)
Written internal	.43	(8)	.32	(8)
Personal internal	.61**†	(2)	.46	(4)
Personal external	.55*†	(5)	.42	(5)
All written	.54*	(6)	.42	(6)
All personal	.62**†	(1)	.47†	(1)
All external	.57	(4)	.47	(2)
All internal	.60**	(3)	.46	(3)
All Modes	.64**		.51	

All correlation coefficients significant at .0001 level.

** Coefficient is statistically greater than for low performing firms (z-score, $p < .05$).

* Coefficient is statistically greater than for low performing firms (z-score, $.05 < p < .10$).

† Personal sources statistically greater than written sources in same column ($.01 < p < .10$).

Tables 2 and 3 showed that for all fifty companies, perceived strategic uncertainty and total scanning frequency were rated highest to lowest for the following sectors: customer, economic, competitor, technological, regulatory, and socio-cultural. Table 6 amplifies those findings by reporting the correlation coefficients between strategic uncertainty and scanning within each sector for each information mode. The correlations indicate the extent to which CEOs tailor scanning frequency for each sector to perceived uncertainty.

Table 6 about here

The prominent finding in Table 6 is that high performing firms show consistently stronger correlations between strategic uncertainty and scanning frequency in each sector than do chief executives in low performing firms. Low performing firms show only six correlations significant at the .05 level or higher, while high performing firms show sixteen correlations that are statistically significant. This suggests that CEOs in high performing firms tailor scanning frequency to perceived uncertainty within each sector. Apparently scanning behavior is not fixed on any sector, but varies with perceived uncertainty and need for information. The lower correlations for low performing firms do not mean that chief executives do not scan each sector, but that scanning behavior does not vary with strategic uncertainty to the same degree.

The second pattern in Table 6 is the sectors showing the strongest correlations. For firms classified as low performing, the technology sector shows a significant correlation through all four modes, followed by the regulatory sector in three modes. This means that chief executives tailor

Table 6: Correlations Between Strategic Uncertainty and Frequency of Scanning for each Sector, by High and Low Performing Companies.

		Strategic Uncertainty			
		High Performing N = 25		Low Performing N = 24	
Scanning Mode	Sector	r	p	r	p
External Sources	Competitor	.39**	.053	.00	.982
	Customer	.49**	.014	.08	.710
	Technological	.56**	.003	.45**	.028
	Regulatory	.35*	.091	.36*	.082
	Economic	.43**	.033	.16	.469
	Socio-Cultural	.59**	.002	.12	.571
Internal Sources	Competitor	.36*	.073	.07	.762
	Customer	.06	.773	.16	.462
	Technological	.45**	.023	.41**	.048
	Regulatory	.54**	.005	.47**	.020
	Economic	.45**	.022	.27	.204
	Socio-Cultural	.53**	.006	.03	.875
Personal Sources	Competitor	.37*	.065	.10	.630
	Customer	.19	.371	.13	.556
	Technological	.46**	.024	.38*	.065
	Regulatory	.65**	.000	.26	.217
	Economic	.47**	.017	.04	.851
	Socio-Cultural	.53**	.007	.16	.462
Written Sources	Competitor	.33*	.107	.02	.938
	Customer	.34*	.096	.29	.162
	Technological	.54**	.005	.47**	.020
	Regulatory	.12	.566	.50**	.012
	Economic	.43**	.032	.51**	.011
	Socio-Cultural	.58**	.002	.05	.807

** $p < .05$
* $p < .10$

scanning to perceived uncertainty in technology, followed by government regulation. Chief executives in high performing firms also show positive correlations in the technology and regulatory sectors. In addition, they show strong correlations through all media for the competition, economic, and socio-cultural sectors. The breadth of scanning is greater in the high performing firms with chief executives acquiring information in response to strategic uncertainty in all sectors. Chief executives in high performing firms seem to have a broader information base. Their external intelligence acquires information about perceived strategic uncertainty in the general environment as well as in the task environment. The breadth of scanning combined with the tailoring of scanning frequency to strategic uncertainty in every sector characterizes the scanning of CEOs in high performing manufacturing firms.

Discussion

The external environment is a significant contingency for organizations (Duncan, 1972; Tung, 1979; Daft, 1986). The purpose of this study was to examine the means through which the environment is scanned and interpreted by chief executives. The research project gathered data to accomplish three outcomes: (1) document whether systematic differences exist in strategic uncertainty across sectors in the task and general environment; (2) determine whether perceived strategic uncertainty is correlated with the frequency of CEO scanning and with the use of personal/written and external/internal modes of information gathering; and (3) assess whether chief executives in high performing firms show different scanning patterns than CEOs in low performing firms.

Environmental Characteristics and Scanning

The interpretation of the data with respect to environmental characteristics is as follows: *sectors differed widely in the amount of strategic uncertainty created for chief executives, and task environment sectors typically had greater strategic uncertainty than sectors in the general environment.* Strategic uncertainty is a combination of perceived change, complexity, and importance. The customer sector rated highest, and the economic sector, generally considered part of the general environment, rated second in strategic uncertainty. The competition sector was rated third. Technology, regulatory, and socio-cultural sectors were ranked fourth, fifth and sixth. This finding reinforces research by Hambrick (1981, 1982), and Brown and Utterback (1985) who adopted a sector approach in their studies of the environment. Earlier studies treated the environment as a single entity, and used a single score of uncertainty. In light of increasing evidence about the diversity of external environments, a single environmental score may not be a useful way to understand how the environment influences organizational actions.

The second finding about the environment is: *chief executives respond to strategic uncertainty across sectors with greater scanning frequency in all modes, and a somewhat greater use of personal compared to written modes.* The literature on organizational information processing states that nonroutine and uncertain tasks require greater information processing (Culnan, 1983; Daft and Macintosh, 1981; Tushman and Nadler, 1978; Galbraith, 1973). The frequency of scanning in this study reflects a greater amount of information processed for uncertain sectors. Moreover, the greater scanning of sectors such as customer and economic are through all media. Chief executives acquire information in ways that reflect strategic differences in sectors. Chief executives do not have equal information about all sectors because information is gathered where uncertainty is greatest.

The increased use of all modes suggests that chief executives use multiple sources to interpret the environment. Written and personal sources may complement one another to give a better view of an uncertain environment. Personal sources are important because their richness enables subtle signals to be detected (Daft and Lengel, 1984). Written media are important because tangible data can be gathered and communicated about discrete events. The increasing preference for personal modes as uncertainty increases reflects the inability to acquire hard data when events are rapidly changing and unclear (Weick, 1986).

Scanning and Performance

The findings from the comparison of high and low performing manufacturing firms suggests the following interpretation: *chief executive scanning in higher performing firms is characterised by more frequent information and more flexibility than scanning by chief executives in lower performing firms.* Executives in high performing firms reported more frequent information through all media when strategic uncertainty is high. Scanning flexibility was reflected in the tailoring of scanning through all modes to perceived uncertainty in each sector. Executives from lower performing firms had correlations between strategic uncertainty and frequency of scanning in the technology sector, and to some extent in the regulatory sector. For executives in high performing companies, however, positive correlations also included competitors, customers, the economy, and socio-cultural sectors. Executives in higher performing companies did not have a limited scanning pattern.

The broad scanning base for executives in high performing firms was unexpected. While greater scanning occurred for all executives in the task sectors, a distinctive feature in high performing firms was the CEO's response to sectors in the general environment. The significance of this finding may be that successful chief executives do not form their impressions based strictly on narrow task environment issues. They might miss opportunities, trends, problems, and other issues that could provide input for incremental adjustments in strategy. Scanning in the successful firms suggests broad information that incorporates intangible and less well understood sectors such as socio-cultural that may contain weak signals about future developments. Understanding the entire environment, and learning about uncertainties across all sectors, may provide a richer information display for the incremental decisions needed for strategy formulation.

Summary and Implications

In summary, chief executives have limited information capacity, and organizations have limited resources. Resources devoted to environmental scanning can be focused on sectors where strategic uncertainty is greatest. For this sample of manufacturing firms, the sectors receiving more scanning were customer, economic, and competitor. Perhaps more important, executives in high performing firms tailored scanning to perceived strategic uncertainty in all sectors. The implication is that scanning systems should not be locked into continuous data on limited sectors of the environment. Management information systems tend to provide periodic information of a repetitive nature. Repetitive data may be valuable for perceiving stable elements in task sectors (Hedberg, 1981; Hedberg and Jonsson, 1978). However, the executives in successful firms maintained information flexibility. They used all sources to receive information so that greater information inputs were from areas of greater strategic concern. Chief executives in successful firms were flexible enough to pick up cues from the general environment when these sectors had strategic relevance for the organization.

The second implication pertains to the debate about whether formal versus informal sources of information provide better input to the organizational planning process (Rhyne, 1985; Fahey, et al., 1981). The data from these executives suggest that both personal and written sources are valued, and that both internal and external sources are used. Most important, the use of all sources increased as strategic uncertainty increased, suggesting that multiple sources are the appropriate information system for chief executives. Written sources provide systematic, periodic data that can show trends and provide other relevant facts. Written sources were especially important for the economic sector. Personal sources provide a view of intangible aspects of the environment that may be filtered out by written media (Daft and Huber, 1986). Thus designers of information systems should not try to provide all information through formal systems. The best view of the environment seems to come from multiple information sources.

To the extent that an organization strategy is incremental (Quinn, 1980), and reflects gradual organizational learning about the environment, bits and pieces of information from diverse sources can be assembled to provide cues to chief executives about the environment. Perhaps future research can go further to reveal the detailed linkage between strategic uncertainty, scanning, and strategic adjustments. Gradually unraveling the sequence of activities associated with scanning and interpretation of the environment may provide a stronger normative basis for saying how organizations can be designed to increase company performance in light of strategic and environmental contingencies.

APPENDIX: SECTOR DEFINITIONS

ENVIRONMENT

This part of the study is concerned with how you monitor and learn about things in the company's external environment. By the external environment we mean all the factors and phenomena that exist outside your company. In this study, we have divided the external environment into six sectors, as illustrated on Chart 1.

(1) THE COMPETITION SECTOR. This sector includes the firms and products that compete with your companies' products, and companies that make substitute products. It also refers to competitive tactics and actions between your firm and the other competing firms in this industry.

(2) THE CUSTOMER SECTOR. This sector refers to those companies or individuals that purchase the products made by your company. Customers include companies that acquire your products for resale, as well as final consumers.

(3) THE TECHNOLOGICAL SECTOR. This sector includes the development of new production techniques and methods, innovation in materials and products, and general trends in research and science relevant to your company.

(4) THE REGULATORY SECTOR. This sector includes federal and state legislation and regulations, city or community policies, and political developments at all levels of government.

(5) THE ECONOMIC SECTOR. This sector includes economic factors such as stock markets, rate of inflation, foreign trade balance, federal and state budgets, interest rates, unemployment, and economic growth rate.

(6) THE SOCIO-CULTURAL SECTOR. This sector comprises social values in the general population, the work ethic, and demographic trends such as an increasing number of women in the work force.

The purpose of the following questions is to determine the profile of each environmental sector. We would like to know how you would rate the importance, complexity, and rate of change of each sector in your company's external environment.

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